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Trajectories of Academic Performance across Compulsory Schooling and Thriving in Young Adulthood

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Abstract

Thriving is a developmental process that is shaped by previous and current interactions within developmental contexts. We hypothesized that academic performance in the school context will positively predict thriving in young adulthood. Data of N = 2,043 students from Zurich was assessed with standardized tests in Grades 1, 3, 6, and 9. Results showed that a stronger increase in academic performance significantly predicted thriving at age 20, even after statistically controlling for various covariates. Further analyses showed that school bonding might represent a mediating link between the academic performance and thriving. We argue that although schools can be considered the most widespread and intensive "youth development program" of sorts, their role for thriving has been largely neglected in developmental science.

Trajectories of Academic Performance across Compulsory Schooling and Thriving in Young Adulthood

A considerable body of research has illustrated that thriving in adolescence is associated with, for example, youths' healthy choices (Schwartz et al., 2010), their ability to set and manage important goals (Napolitano, Bowers, Gestsdóttir, & Chase, 2011), their participation in high-quality outside of school time programs (Mueller, Phelps, Bowers, Agans, Urban, & Lerner, 2011), and their supportive parents and mentors (Lewin-Bizan, Bowers, & Lerner, 2010). Accordingly, the relational approach that underlies contemporary developmental science (e.g., Overton, 2015), and the Positive Youth Development (hereafter, PYD) field specifically, emphasizes that development occurs through co-acting influences at the biological, psychological, and contextual levels. Also central to a relational perspective is the concept of developmental plasticity (Lerner, 1984) stating that one's developmental trajectory is not fixed at birth, or rigidly set by childhood, but rather changeable across the entire life span.

The present research, based on data from the Zurich Learning Progress Study, examines developmental plasticity in a sample of children (and later adolescents) who have attended the Swiss school system from school entry at age 7 at least until the end of compulsory schooling nine years later. We examine whether – controlling for key individual- and family-level factors – students' performance on standardized tests across childhood and adolescence predicts the extent to which they are thriving at age 20. We begin by briefly reviewing the literature on the concept (Lerner, Lerner, Bowers, & Geldhof, 2015) and empirical measure (Geldhof, Bowers, Mueller, Napolitano, Callina, & Lerner, 2014) of thriving in adolescence. We then review the literature on schools and academic performance, and synthesize these literatures in a final introductory section.

Positive Youth Development

The PYD perspective e.g., Lerner et al., 2011), like much of contemporary developmental science, is based in a relational meta-theory (e.g., Overton, 2015), wherein development is best understood in terms of the complex coactions between factors at various levels of a person's developmental system. Representing a conceptual contrast to historically prominent deficit-based adolescence research (see Lerner & Steinberg, 2004), the PYD approach considers thriving as "growth in the attributes that mark a flourishing, healthy young person" (Lerner, von Eye, Lerner, & Lewin-Bizan, 2009, p. 568), rather than the absence of problems. Taken together, the PYD perspective holds that thriving – "manifesting healthy, positive developmental changes" (Lerner, von Eye, Lerner, Lewin-Bizan, & Bowers, 2010, p. 707) – occurs through the dynamic interplay of youth strengths (e.g., academic abilities) and contextual assets (e.g., supportive schools).

The most prominent conceptual and empirical operationalization of PYD is the Lerner and Lerner "Five Cs" model (for a review see Lerner, Lerner et al., 2011). This approach uses a variety of validated developmental measures (e.g., the self-perception profile for children by Harter, 1985) to operationalize PYD as a constellation of several psychosocial domains, termed the "Five Cs" — *competence* (i.e., a positive view of one's skills and abilities), *confidence* (i.e., an internal sense of overall positive self-worth), *character* (i.e., respect for societal and cultural rules), *connection* (i.e., positive bonds with people and institutions), and *caring* (i.e., a sense of sympathy for others). The model proposes that youth are thriving when they report high levels of each of these "Five Cs". One reason for the prominence of the Lerner and Lerner PYD model is the large body of empirical research supporting it (see Bowers et al., 2015, for a review). There is considerable evidence for the main theoretical proposal of the PYD model: that when *youth strengths* bidirectionally interact with *ecological assets*, thriving occurs (see Lerner et al., 2015 for a review of this research).

Much of this existing research on the antecedents of PYD focuses on the effects of one prominent category of ecological assets, namely outside-of-school time youth development programs. In general, results suggest that actively participating in youth development programs promotes thriving across adolescence, as indexed with growth in the levels of PYD (e.g., Champine et al., 2016). While informative and influential, this work may be susceptible to criticisms regarding endogeneity biases. Participation in youth development programs is increasingly widespread, but it is not required. In some settings, participating teens may enter these programs with higher levels of PYD than their non-participating peers.

Schools and Academic Performance

Notably, the relation between PYD and youth engagement in the only "youth development program" of sorts that *is* compulsory – the educational system itself – has received comparatively less focus to date (but see work on school engagement; e.g., Li & Lerner, 2011). This is somewhat surprising given that, besides the family of origin, schools may represent the most important developmental context for children and adolescents and academic achievement represents a highly salient developmental issue at this age. The influence of schools exists across several domains and operates in complex causal chains across different levels of analysis such as academic work itself, groups and activity structures, student-teacher relationships, or the school culture (for overview, see Eccles & Roeser, 2011). As a consequence, schools affect youths' social, emotional, behavioral, and cognitive development simultaneously (Noddings, 2005). This breadth is also reflected in schools' diverse non-academic educational aims (e.g., emotional and motivational self-regulation, conscientiousness, and prosociality; see Roeser, Urdan, & Stephens, 2009). But clearly, academic knowledge and skill development remains the central focus of schooling, which is reflected in the way how individual students, schools, and educational systems as a whole are judged (see already Dunkin & Biddle, 1974).

It is not very surprising, then, to find that virtually all studies dealing with academic performance treat it as an outcome variable, investigate its possible predictors, or scrutinize interventions to promote learning effectiveness (see Richardson, Abraham, & Bond, 2012, for a review). In developmental terms, academic achievement tends to increase very quickly in childhood (with $d > 1.00$ per school year early in elementary school) and to level out in adolescence (with $d < .30$ per school year at the end of high school; e.g., Bloom, Hill, Black, & Lipsey, 2008). And although we know from the literature that the rank stability in academic achievement can be quite high (e.g., Guay et al., 2003, report stabilities of $.65 < r_{tt} < .81$ for a 1-year interval), there are of course between-person differences in this stability. Factors associated with these differences are located both at the psychosocial (e.g., Guay et al., 2003) and the contextual level (e.g., Jimerson, Egeland, & Teo, 1999) and range from genetic factors (e.g., Rietveld et al., 2013) and early childhood experiences (e.g., Jimerson et al., 1999) to concurrent stressful life events (e.g., Pungello, Kupersmidt, Buchinal, & Patterson, 1996) and even the course of the school year (e.g., Corpus, McClintic-Gilbert, & Hayenga, 2009). Also very specific factors, such as the availability of a school breakfast, have received attention in the scientific community (e.g., Kleinman et al., 2002).

Substantially fewer studies considered academic performance in school as an independent variable and investigated its *consequences*. The existing studies that did so typically assessed related academic or achievement processes, such as academic self-concept (Guay, Marsh, & Boivin, 2003), the choice of a college major (Trautwein & Lüdtke, 2007), the choice of an occupation (J. Heckhausen & Tomasik, 2002), or earnings later in life (Zax & Rees, 2002). Some studies, however, also investigated effects of academic performance that were not directly related to the domain of achievement. For instance, Eccles (2009) argued that interindividual differences in academic performance can influence identity development

via self-perceptions about one's skills and personal goals. Similarly, Masten et al. (2005) showed that academic performance predicts internalizing symptoms in later life.

Although studies predicting more general aspects of development by school performance are rare, there are good reasons to assume a positive association if one considers some basic concepts of human motivation. From a macro perspective, competence can be considered a fundamental need "to experience satisfaction in exercising and extending one's capabilities" (Levesque, Zuehlke, Stanek, & Ryan, 2004, p. 68) and its successful fulfillment is associated with intrinsic motivation, effective self-regulation, positive social development, and well-being (Ryan & Deci, 2000). Against this backdrop, we will outline below why the school setting, in which competence is highly valued and a formal evaluation of competence takes place on a daily basis, represents a developmental context in which the association between (perceived) competence and thriving can be particularly strong. If this is the case, we would assume that children and adolescents who experience competence within one of the most central developmental tasks during that age period will more likely internalize socially accepted values, more effectively regulate external demands, and more strongly accumulate psychological assets that will promote thriving.

Linking Academic Performance and Positive Youth Development

We take an explicitly relational meta-theoretical position (e.g., Overton, 2015) in this research, conceptualizing academic performance as the bidirectional result of youth strengths and the school context. Our conceptualization contrasts from those viewing academic performance simply as a marker of individual ability or instead as marker of school or teacher quality (as seen in some educational policy interventions). In other words, we consider school performance as the extent to which youth harness their strengths to make effective use of the assets that school offers. In addition to its fidelity to the relational approach prominent in developmental science, this position is consistent with educational research showing that

academic performance is a function of *both* the instructional quality *and* the students' readiness to make use of instructional opportunities (e.g., Brühwiler & Blatchford, 2011).

Academic Performance Predicts PYD

Against this notion of person-environment-fit that is central to both developmental and educational approaches, we hypothesized that academic performance and its growth from childhood through adolescence promotes PYD in young adults in their twenties (Hypothesis 1). In doing so, we wanted to scrutinize the common but largely untested assumption that education has broad developmental benefits outside achievement and earnings. We take a relational perspective by considering the increase of academic achievement as a complex developmental process that is associated to other developmental processes before and during the schooling period. Given the high salience of school achievement in childhood and adolescence, changes in school achievement thus might be considered a sensible and sensitive indicator of successful development during this age period and consequently predict PYD in the following period of life.

Possible Confounders

Incorporating a relational perspective that considers potential effects from across the developmental system, while also supporting notions of developmental plasticity, we further hypothesized that the relation between academic achievement and PYD remains significant even when controlling for what the youth "brings to the table" at school entry: that is, his or her levels of intelligence, baseline academic performance, family educational assets (in the sense of cultural capital as introduced by Bourdieu, 1986), age at school entry, gender, and heritage language (Hypothesis 2). Including these covariates in the analyses also allows us to test their role as alternative explanations for the link between school performance and PYD. All these variables are known to be associated with school performance or its development over time. For instance, family educational assets are a strong predictor of academic

performance, already at the elementary school level (e.g., Lee & Bowen, 2006). Similar effects are known for psychometric intelligence (e.g., Rindermann & Neubauer, 2004), baseline academic performance (e.g., Fan, 2001), age at school entry (e.g., Stipek, 2002), gender (e.g., Steinmayr & Spinath, 2008), and heritage language (e.g., Levels, Dronkers, & Kraaykamp, 2008). Taken together, we propose that academic performance *itself* is a pathway to thriving even when controlling for an array of variables that are also strongly associated with academic performance.

School Bonding as a Mediating Process

Explanations beyond our direct hypothesis are also plausible. One could conceive various underlying processes that link academic performance with PYD, but due to a lack of research in this domain, there is limited empirical evidence useful for formulating strong hypotheses. One notable exception is research on school bonding. Therefore, a further purpose of this work is to empirically scrutinize school bonding as a potential mediating process. School bonding can be defined as feeling related to school, valuing educational goals, and participating in academic and nonacademic activities (Finn, 1989; Li & Lerner, 2011). It is considered an important developmental asset related to thriving (Scales, Benson, Leffert, & Blyth, 2000) and a critical element in the developmental experience of children from various theoretical perspectives (e.g., attachment theory, control theory, or social development theory; see Catalano, Haggerty, Oesterle, Fleming, & Hawkings, 2004). School bonding hence may take on a mediating role, providing a psychological conduit through which the effects of school assets (e.g., high quality teaching or a quality teacher-child relationship) impact processes such as peer acceptance or PYD (Hughes & Kwok, 2006; Li, Lerner, & Lerner, 2011). For example, in longitudinal research, youth who were actively engaged in their education (i.e., felt connected to school, completed homework assignments, or endorsed educational goals) reported higher levels of PYD and academic performance (Li

& Lerner, 2013). There is also some research demonstrating school bonding as an important process underlying substance use prevention programs (e.g., Wenzel, Weichold, & Silbereisen, 2009; see also Bryant, Schulenberg, O'Malley, Bachmann, & Johnston, 2003). Although many authors consider school achievement as a consequence of school bonding (e.g., Maddox & Prinz, 2003), there is some evidence that school achievement also antedates school bonding (e.g., Hoffmann, Erickson, & Spence, 2013) and related variables such as abstinence from drug use (Henry, 2010). We argue with Hagenauer and Hascher (2014) and assume a circular association between bonding and achievement: higher school bonding leads to better achievement (which could be mediated by higher academic values and school engagement) but at the same time better achievement (and hence experience of school success as well as perception of control in the academic domain) leads to higher school bonding. Against this backdrop, we hypothesized that increases in academic performance may lead youth to feel more bonded with their school, and given that the school can provide a rich and diverse set of resources for youth beyond plain academics, school bonding should promote PYD, holistically measured (Hypothesis 3).

Method

Sampling and Procedure

The target population of the Zurich Learning Progress Study were all 11,118 children from the Canton of Zurich, Switzerland, who officially enrolled in the 2003/04 school year in one of the 650 first grade classes of a regular elementary school (i.e., excluding schools for children with special needs and schools with mixed age classes). Four strata were predefined representing different types of first classes. From this target population, a stratified random sample of 120 classes totaling $N = 2{,}043$ students was drawn proportional to class size. For *all* following analyses, data of this sample were weighted according to stratum membership, class size, and non-response within classes so that the weighted sample depicts a true

representation of the student target population in the Canton of Zurich. On average, children were $M = 6.95$ ($SD = .37$) years old when entering elementary school. There were slightly more boys (50.8%) than girls in the sample and consistent with demographic trends, 24.4% of the children did not speak German, i.e. the school language, at home. Every fifth student (20.1%) had to repeat a grade at least once during elementary school whereas 1.2% skipped one or more grades. In secondary school, 3.8% repeated and 0.4% skipped one or more grades.

The first assessment (T1) was conducted immediately after school enrollment in September 2003 when the children were around 7 years old. At this measurement occasion, we tested the students' *pre-schooling knowledge* in terms of reading competencies, vocabulary, mathematical understanding, and also *psychometric intelligence*. The second assessment (T2; around age of 10 years) took place at the end of third grade, when *academic performance* in mathematics and German was assessed together with other motivational and socio-emotional variables. The third assessment (T3; around age of 13 years) took place shortly before the summer vacations at the end of sixth grade, which is the last year of elementary school and hence the last one without any tracking.

After T3, students moved on to one of the three tracks of secondary school (lower vocational track, upper vocational track, or college bound track), depending on their school grades and an optional entry exam. In the school year following T3, 27.6% attended the lower vocational track, 41.5% the upper vocational track, 14.7% the college bound track, and the remaining 16.2% still were in elementary school. In the following year, 39.3% attended the lower vocational track, 47.1% the upper vocational track 13.2% the college bound track, and 0.3% were still in elementary school.

Three years after T3, a fourth assessment (T4; around age of 16 years) was conducted at the end of compulsory schooling. Just like the two times before, academic performance in

mathematics and German was tested together with other motivational and socio-emotional variables. As the students were in different school tracks at this measurement point, only learning content that was part of the curriculum in all tracks was assessed. In addition, psychometric intelligence was tested and students were asked about their vocational and educational goals in the future.

In fall 2016, more than 13 years after the first assessment when the participants were around 20 years old, participants were contacted again and invited to participate an online survey (T5). Approximately every second young adult accepted that invitation and provided a self-report on their current life circumstances as well as their experiences with their last educational transitions and filled out a questionnaire assessing PYD.

Measures

Standardized achievement tests. Academic performance in mathematics and German was assessed by means of standardized tests that were developed to represent the official school curriculum of the Canton of Zurich. All items were designed in collaboration with trained teaching personnel and evaluated by didactics experts with regard to their relevance for the curriculum. All items were pretested and tentatively scaled with probabilistic methods to ensure that the item difficulties would cover the entire range of expected student abilities. The tests comprised at least four content domains in mathematics (arithmetic, sizes/story problems/proportions, problem solving, and geometry) and four content domains in German (reading comprehension, vocabulary, language reflection, and revising texts) plus additional content domains relevant only in the respective school year. The test was administered individually to each student by research assistants in Grade 1. In Grades 3 and 6 the test was administered in groups by the class teacher. In Grade 9, the test was administered by a research assistant and in small groups of students who were taken out

of their regular classes on a school morning. All tests were marked by trained research personnel using standardized answer keys.

The tests were scaled according to the probabilistic Rasch model (see Bond & Fox, 2015) from which WLE ability estimates (Warm, 1989) were drawn. Compliance of the items with the model was assessed using a weighted mean square fit statistic (see Wright & Masters, 1982, p. 99). In addition to that, items with extreme difficulties and those with low item-total correlations were excluded from further consideration. Finally, item characteristic curves were inspected visually and only those items retained that did not show unusual patterns across the entire continuum. Information on item scaling can be found in Appendix 1.

For the subsequent analyses, we modelled academic performance in terms of a second-order intercept (referring to Grade 3) and a second order slope (referring to change between Grade 3 and 9) based on two latent growth models, one for each school subject. To allow for a nonlinear increase in academic performance we freed the third loading of the slopes for conceptual and empirical reasons. From the literature, one would expect a substantial decline of performance gains in secondary as compared to elementary school (see Bloom et al., 2008). Empirically, a linear model indeed fit much worse ($\Delta\chi^2 = 1538.81$, $df = 2$, $p < .001$) than the non-linear model that we finally used. This free-shape model, which itself fit the data very well ($\chi^2 = 65.21$, $df = 10$, $p < .001$; RMSEA = .052; CFI = .988; TLI = .982), is depicted in Figure 1. The unstandardized loadings on the slope factors were $\lambda_3 = .00$, $\lambda_6 = 1.00$, and $\lambda_9 = 1.15$ for mathematics and $\lambda_3 = .00$, $\lambda_6 = 1.00$, and $\lambda_9 = 1.37$ for German. Both the intercept and the slope showed significant variance (ps < .001). Performance gains in mathematics amounted to $d = .78$ per school year in elementary school and $d = .14$ in secondary school using pooled within-grade variance for standardization. In German, the respective performance gains were $d = .44$ per school year in elementary school and $d = .31$ in

secondary school. These are typical increases observed across compulsory schooling (see Bloom et al., 2008).

Positive youth development. Our measure of positive youth development (PYD) derived from the Lerner and Lerner "Five Cs" model (Lerner, Lerner et al., 2011). Although early work in measuring PYD from this perspective involved modeling a hierarchical second order factor (e.g., Phelps et al., 2009), more recent work argued that a "very short form" (VSF) of 17 items parsimoniously models PYD across adolescence (Geldhof et al., 2014) As such, in this research, PYD was assessed at the end of the online survey (T5) with the 17 VSF items recommended by Geldhof et al. (2014). All 17 items were back-translated from English to German by bilingual research assistants. Selected examples of item wording can be found in Appendix 2.

After an initial screening of the inter-item and the item-total correlations, we removed three items with negative or zero correlations, retained 14 items for a confirmatory factor analysis, and specified a bifactor measurement model adopted from Geldhof et al. (2014). This model is comprised of one general factor capturing covariance that is common to all items (PYD) and five residual factors uncorrelated with the general factor capturing covariance that is specific to items from each of the five "C" subscales. Our model fit the data well ($\chi^2 = 97.68$, $df = 68$, $p = .01$; RMSEA = .020; CFI = .975; TLI = .967) and substantially better than a single factor model ($\chi^2 = 727.63$, $df = 75$, $p < .001$; RMSEA = .091; CFI = .455; TLI = .339). The loadings on the general PYD factor – constrained to be tau-equivalent across all 14 items as suggested by Pohl, Steyer, and Kraus (2007) – were significant and the general PYD factor comprised significant variance ($p < .001$) for further calculations. The standardized loadings are presented in Table 2. The internal consistency of the general PYD factor was $\omega = .77$ (resp. $\omega_h = .48$, which must be lower than ω as demonstrated by Zinbarg,

Revelle, Yovel, & Li, 2005). We used the bi-factor model for all following calculations, operationalizing positive youth development as the general PYD factor.

Psychometric intelligence. During the assessments in Grade 1, the Culture Fair Test (CFT 1; Weiß & Osterland, 1997) was administered by trained research assistants in order to assess basic cognitive abilities devoid of sociocultural influences. This test was chosen in order not to disadvantage children who did not speak German at home. The tests were scaled according to the probabilistic Rasch model from which WLE ability estimates were calculated. The internal consistency of the test was $\alpha = .96$ (EAP reliability = .92) and thus very high. In a normative sample, the criterion validity with the German version of the Wechsler Intelligence Scale for Children (HAWIK) is $r = .48$ for verbal part and $r = .66$ for the action part (see Weiß & Osterland, 1997).

Family educational assets. Two indicators of the family educational assets were assessed in Grade 1. Parents reported their highest educational attainment that was recoded into years of schooling, and children reported the number of books that their family had at home. When this data was not available at the first measurement occasion, it was obtained from the subsequent occasions. On average, parents reported to have completed $M = 12.58$ ($SD = 3.52$) years of schooling and children reported to have $M = 177.62$ ($SD = 170.22$) books at home. We combined these two manifest variables into one latent factor by equating both unstandardized loadings.

School bonding. The emotional engagement aspect of school bonding was measured by three items developed by Buff and colleagues (2007) for the purpose of this study. The items wordings were “In the morning, I am glad going to school”, “I am fed up going to school”, and “What I am doing in school is boring” and students could endorse the items on a scale ranging from 1 (“does not apply at all”) to 4 (“precisely applies”). After recoding the negatively formulated items, the scale means were $M = 3.22$ ($SD = .82$) at T2, $M = 2.86$ ($SD =$

.74) at T3, and $M = 2.52$ ($SD = .60$) at T4. For the subsequent analyses, we set up a latent growth model with $\lambda_3 = .00$ and $\lambda_6 = 1.00$ fixed and λ_9 set free for estimation. After allowing three measurement error correlations for the initially negatively formulated items, the model fit the data satisfactorily ($\chi^2 = 182.38$, $df = 29$, $p < .001$; RMSEA = .052; CFI = .939; TLI = .925). The third slope loading was estimated at $\lambda_9 = 2.05$, suggesting an almost linear average trajectory. The intercept was estimated at $M = 3.40$ and the slope at $M = -.31$, whereby the mean was significantly different from zero ($p < .001$), suggesting a decline in school bonding over the course of compulsory schooling. Both the intercept ($p < .001$) and the slope ($p = .016$) showed significant variance.

Socio-demographic variables. Children's age and gender were obtained from the official school records. The language most often spoken at home at the time of elementary school enrollment was obtained from parent's or children's reports in Grade 1 but if this information was not available, it was imputed from reports at subsequent measurement occasions.

Longitudinal Sample Selectivity

The participation rates for all five measurement occasions are presented in Table 1. There is a sharp decline in participation for the online survey at T5. This decline is selective on both socio-demographic and achievement-related variables. As compared to non-participants and those who have moved away, retained participants' parents were on average more likely to own more books at home ($F[2, 1704] = 24.48$, $p < .001$, $\eta^2 = .028$). These students also had better scores in reading ($F[2, 1712] = 36.36$, $p < .001$, $\eta^2 = .041$), vocabulary ($F[2, 1712] = 28.96$, $p < .001$, $\eta^2 = .033$), and mathematics ($F[2, 1712] = 24.32$, $p < .001$, $\eta^2 = .028$) already just after entering school (T1), and at the end of compulsory school (T4) they also had higher test scores in German ($F[2, 1432] = 55.53$, $p < .001$, $\eta^2 = .072$) and mathematics ($F[2, 1433] = 32.04$, $p < .001$, $\eta^2 = .043$). Whereas on the achievement-related

variables, participants differed from both the non-participants and those who have moved away, on the socio-demographic variables they differed only from the non-participants but not from those who have moved away. Hence, as compared to the non-participants, they were more likely to be female (F[2, 1782] = 17.18, $p < .001$, $\eta^2 = .019$), to be slightly younger (F[2, 1782] = 8.54, $p < .001$, $\eta^2 = .009$), to have no foreign language background (F[2, 1782] = 6.27, $p = .002$, $\eta^2 = .007$), and to have more educated parents (F[2, 1725] = 8.27, $p < .001$, $\eta^2 = .010$). Overall, the selectivity effect sizes are very small for the sociodemographic variables and small for the achievement-related variables.

Results

We tested our hypothesis by setting up a Model 1 in which PYD was regressed on the intercept and the slope of academic performance and then subsequently added the covariates in Models 2 through 4 to scrutinize whether the hypothesized effects remained significant. The covariates were regressed on both PYD and school performance simultaneously. In Model 5, finally, we tested whether the slope of school bonding mediates the regression of PYD on the slope of academic achievement. This model was set up as a parallel process growth model with directed effects in which PYD was regressed on the intercept and the slope of academic achievement as well as the intercept and the slope of school boding. Furthermore, the slope of academic achievement was regressed on the intercept of school bonding and the slope of school bonding was regressed on the intercept of academic achievement in this model. An alternative to this parameterization would have been to let the respective two factors correlated freely, but we decided to introduce directed effects because of the temporal ordering of them.

All analyses were performed in Mplus 6.12 (Muthén & Muthén, 2010) using the MLR estimator and weighting by the normalized student weight. Because students were sampled from school classes, we corrected the standard errors with the COMPLEX function using

class membership one of the 56 school districts as the CLUSTER variable. We chose to use this higher order class membership in order to avoid potential issues of cross-classification (see Cameron & Miller, 2015; Gilbert, Petscher, Compton, & Schatschneider, 2016) as students changed schools (but mostly not the school district) after T3. Missing values were handled by multiple imputation with 20 replication data sets and taking into account the nested structure of the data. Average coefficients across the 20 replication data sets are reported with the exception of the indirect effect coefficient that cannot be calculated within the multiple imputation framework of MPlus 6.12. The indirect effect in Model 5 was based on a FIML estimate and calculated using the MODEL INDIRECT command. Initial model fit was gauged by the root mean square error of approximation (RMSEA), the Comparative Fit index (CFI), and the Tucker-Lewis Index (TLI). Indications of acceptable fit were CFI and TLI above .90, and RMSEA below .08 (see Little, 2013). Despite the fact that our main hypotheses were directional, all significance testing was performed two-tailed. All regression coefficients are summarized in Table 3.

Initial Analyses: Academic Performance Predicts PYD

Model 1 fit the data well ($\chi^2 = 501.31$, $df = 150$, $p < .001$; RMSEA = .034; CFI = .953; TLI = .940). In this model, PYD was significantly predicted by the slope of academic performance ($\beta = .40$; $SE = .18$; $p = .024$) but not by its intercept ($\beta = .02$; $SE = .21$; $p = .93$). The results show that students who increase their academic performance over the course of compulsory schooling more than others report significantly higher levels of PYD in young adulthood. Around 18% of the variance in the latent PYD variable was explained by academic performance, which corresponds to a medium to strong effect size (Cohen, 1992). Concerning the residual factors in the PYD bi-factor model, all but one of them were not significantly related to academic performance so that we will not discuss them anymore in the following.[1]

Follow-up Analyses: Academic Performance Predicts PYD, Controlling for Covariates

In the Model 2, we included baseline psychometric intelligence and pre-schooling knowledge as covariates. The model fit the data well (χ^2 = 707.10, *df* = 195, $p < .001$; RMSEA = .036; CFI = .944; TLI = .927). Intelligence significantly predicted both the intercept (β = .31; *SE* = .04; $p < .001$) and the slope of academic performance (β = .12; *SE* = .05; $p = .026$) whereas pre-schooling knowledge only predicted the intercept (β = .53; *SE* = .05; $p < .001$) but not the slope (β = -.06; *SE* = .06; $p = .33$). More importantly, however, neither intelligence (β = -.03; *SE* = .18; $p = .88$) nor pre-schooling knowledge (β = -.28; *SE* = .27; $p = .30$) significantly predicted PYD. The effect of the slope of academic performance slightly increased (β = .43; *SE* = .17; $p = .010$) after considering the two covariates. The model explained 23% of the variance in PYD.

In Model 3, we included family educational assets as an additional covariate. This model also fit well (χ^2 = 830.35, *df* = 231, $p < .001$; RMSEA = .036; CFI = .941; TLI = .924). In addition to the already entered covariates, educational assets predicted both the intercept (β = .37; *SE* = .04; $p < .001$) and the slope of school performance (β = .28; *SE* = .06; $p < .001$) but were not associated with PYD (β = -.09; *SE* = .20; $p = .66$) and the effect of the academic performance slope remained stable (β = .46; *SE* = .20; $p = .023$). The explained variance amounted to 24%.

In Model 4, we included age at school enrollment, gender, and language spoken at home as covariates. The model demonstrated a borderline acceptable fit to the data (χ^2 = 1069.72, *df* = 273, $p < .001$; RMSEA = .038; CFI = .925; TLI = .898). In addition to the already entered covariates, gender predicted the intercept of school performance (β = .13; *SE* = .03; $p < .001$; with girls outperforming the boys) and younger age at school entry predicted a steeper slope (β = -.12; *SE* = .05; $p = .014$). All other effects of age, gender, or language were not significantly related to school performance ($.21 < p < .98$). More importantly, neither age (β = .06; *SE* = .12; $p = .61$) nor language (β = .12; *SE* = .13; $p = .37$) nor gender (β

= .19; *SE* = .12; *p* = .12) had a significant effect on PYD. The effect of the slope of academic performance dropped slightly but remained significant (β = .43; *SE* = .20; *p* = .035). All variables taken together explained R^2 = .28 of the variance in the latent PYD variable.

A Potential Mediating Process: The Role of School Bonding

Model 5 was set up to test the mediating role of school bonding. It showed an acceptable fit to the data (χ^2 = 1373.39, *df* = 368, *p* < .001; RMSEA = .037; CFI = .923; TLI = .915). PYD was significantly predicted by both the intercept (β = .61; *SE* = .11; *p* < .001) and, most importantly for testing the mediation, by the slope of school bonding (β = .30; *SE* = .15; *p* = .046). Furthermore, the slope of school bonding was significantly predicted by both the intercept (β = .09; *SE* = .05; *p* = .050) and, again most importantly for testing the mediation, by the slope of academic achievement (β = .19; *SE* = .07; *p* = .009). In other words, higher levels of academic achievement in Grade 3 and a steeper increase in academic achievement throughout Grade 9 predicted a steeper increase in school bonding from Grade 3 to Grade 9, which in turn predicted higher levels of PYD at age 20.

The hitherto significant path from the slope of academic achievement to PYD substantially dropped and just missed significance (β = .16; *SE* = .09; *p* = .071), which suggests a substantial mediation effect. This interpretation is supported by the significant indirect effect from the slope of school achievement via the slope of school bonding to PYD (β_{total} = .05; *SE* = .02; *p* = .026). The size of the indirect effect is κ^2 = .06 and thus small to medium according to Preacher and Kelley (2011). Unrelated to any of our hypotheses but interesting on its own was the fact the intercept of school bonding negatively predicted the slope of school achievement (β = -.17; *SE* = .06; *p* = .006).

Testing for Reverse Causality

In order to test the direction of effects between academic achievement and school bonding – something that cannot be done with parallel process latent growth models – we set

up a cross-lagged regression model for the two variables. The model fit the data well (χ^2 = 1373.39, *df* = 368, $p < .001$; RMSEA = .037; CFI = .923; TLI = .915) and suggested a reciprocal relationship between the two variables. The cross-lagged paths from academic achievement to school bonding were positive ($\beta = .05$; *SE* = .02; $p = .019$) whereas the cross-lagged paths from school bonding to academic achievement were negative ($\beta = -.04$; *SE* = .02; $p = .032$). The latter finding resembles the negative intercept-slope correlation between the two variables that we have found in the last growth model. The stabilities across three years were high for both academic achievement ($.91 < \beta < .95$; *SE* = .02; $p < .001$) and school bonding ($.64 < \beta < .73$; *SE* = .02; $p < .001$). It seems that the positive slope-slope association between academic achievement and school bonding in Model 5 is best explained by a preponderant directed effect from achievement to bonding and not vice versa.

Discussion

The purpose of the present study was to test the hypothesis that positive trajectories of academic performance from childhood to adolescence can predict thriving in young adulthood, when controlling for individual differences in pre-schooling knowledge and parental factors. In other words, we tested whether students who improve their academic performance across their education put themselves on a pathway to positive development as they transition into adulthood. To limit potential criticism that this the positive association between academic performance and PYD is simply an obvious result, we note that the opposite relation is also plausible: high academic performance in adolescence may lead to maladaptive development (i.e., “burnout”) in high stress situations (e.g., Salmela-Aro & Tynkkynen, 2012). Furthermore, we also hypothesized that this effect would be at least partially mediated by school bonding as this is a construct related to both academic performance and thriving.

Our results provide strong support for our central hypotheses. Improvements in academic performance in childhood and adolescence significantly predicted thriving in young adulthood among a representative sample of Zurich youth. More specifically, we found that a steeper increase in academic performance over the course of compulsory schooling predicts young adult thriving at a medium-to-large effect size. This result is compatible with Havighurst's (1948) fundamental assumption that the successful mastery of a current developmental task (i.e., school success in childhood and adolescence) is a prerequisite for the successful mastery of following developmental tasks (i.e., competence, confidence, character, caring, and connection in young adulthood).

Because the slope of academic performance – rather than its intercept – was significantly associated with PYD, our research suggests that thriving is not a function of what the student "brings to the table" at school entry and that thriving is possible at all levels of performance, i.e. both in the low-achieving and in the high-achieving students and both in those who are who are disadvantaged at the beginning of their school career and those who are privileged. Thriving is rather fueled by the process of knowledge acquisition itself and, as well, the students' experience of making faster progress relative to their classmates. Conceptually speaking, those who seize the opportunities provided by their developmental context and make best use of them are those who are thriving most in the long run. This result, therefore, provides strong evidence of the developmental plasticity that schooling (and probably other positive contexts of development) can provide youth. In other words, our results suggest that success in school can set the stage for future thriving.

It seems unlikely that this finding is a spurious one for at least two reasons. First, we have controlled for a whole set of theoretically relevant covariates and none of them significantly predicted PYD when school performance was considered as a predictor or attenuated the relationship between school performance and PYD. Although literature linking

intelligence or parental education to PYD is limited, these non-significant relations provide further support for our hypothesis. Second, because the variance of the slope is usually higher than the variance of the intercept and because of statistical power issues (see Hertzog, Lindenberger, Ghisletta, & von Oertzen, 2006), associations with or between slopes are much more difficult to detect than associations of or between intercepts.

School Bonding as a Mediating Process between Academic Achievement and PYD

There are various potential processes that might link academic performance with thriving and we have demonstrated that school bonding is a good candidate. Our interpretation of this finding builds on previous correlative and intervention research on the role of school bonding in adolescent development (e.g., Bryant et al., 2003; Li & Lerner, 2013). We believe that school bonding represents an indicator for a whole set of beliefs and behaviors that can promote thriving and it is a strength of the study to have measured school bonding in a very much generalized way, thus possibly capturing a large variety of them.

Youth having strong bonds to the normative setting of school are more likely to engage in behaviors that are compatible with the positive norms prevalent in schools such as investing time and effort into learning activities and helping others who have learning difficulties, adhering to rules of working and playing together, investing into positive social relationships with both their peers and their teachers, and constructively using their leisure time in afternoon activities offered by school such as sports or other clubs (see Wenzel et al., 2003). All these are closely related to thriving as defined by the "Five Cs." From a skill development model perspective, academic success in turn is related to higher school bonding (e.g., Johnson, Crosnoe, & Elder, 2001) whereas academic failure will have the opposite effect that can range to school absenteeism and school drop-out (e.g., Henry, Knight, & Thornberry, 2012). Possible pathways between academic achievement and school bonding

might be related to the fulfilment of the need for competence, control beliefs, academic self-concept, self-serving social comparisons, or self-protective attributions after failure.

Against this backdrop, the findings that the intercept of school bonding and the slope of school achievement were negatively correlated (in the growth model) and that higher school bonding predicted a decline in school achievement over time (in the cross-lagged model) were somehow unexpected. We can only speculate here about their meaning, but it could be that students who experience unduly positive emotions with regard to school might not take learning very much seriously (e.g., Pekrun, 2006); or that school bonding reflects strong peer relationships and this overemphasis on peers then relates to declines in academic achievement[3], an effect similar to that known from research on iatrogenic effects in peer-group interventions (e.g., Dishion, McCord, & Poulin, 1999). Interestingly, although most studies found positive effects of school bonding on academic success, there are some studies showing that some aspects of school bonding might be unrelated or even negative correlated with achievement (e.g., school commitment in Bryan, Moore-Thomas, Gaenzle, Kim, Lin, & Na, 2012). More research is needed to investigate how the different affective, behavioral, and cognitive aspects of school bonding relate the academic achievement and positive youth development.

Other Potential Underlying Processes

There are clearly other psychosocial processes not assessed in this research that may facilitate the relations between academic performance and an adolescent's thriving. In an abstract sense, academic performance provides an adolescent with means that he or she can use to agentically improve his or her life. One example of such means are self-regulatory skills or strategies that are clearly relevant for school success, but are also predictive for success in virtually all other domains of life. And indeed, research shows that academic performance is positively correlated with more adaptive self-regulation strategies (e.g.,

Villavicencio & Bernardo, 2013), which in turn are good predictors of PYD (Napolitano et al., 2011). Also, one can expect that the fulfillment of the competence need as index by high school performance will strengthen young people's motivational capacities. Classic theories of achievement motivation (e.g., H. Heckhausen, 1977) suggest that a successful mastery of achievement-related tasks will result in more ambitious task choice and more persistence in goal striving in the future, it will promote positive self-evaluations, and build up notions of self-efficacy (e.g., Zimmermann, 1995). But there are also more tangible means that education conveys, such as foreign language competencies, social skills, or general knowledge that allow youth to engage in domains such as volunteering or international exchange. And indeed, high-achieving students report greater intercultural sensitivity than their more-average achieving peers (Holm, Nokelainen, & Tirri, 2009).

Higher academic performance does not only provide more efficient means to negotiate one's development but also opens up new opportunities and developmental pathways. There is some evidence for this idea. For instance, J. Heckhausen and Tomasik (2002) showed that academic performance at the transition from school to work was directly linked with occupational options that were not only considered as more attractive by the students but also offered more career opportunities, socioeconomic rewards, and job security. Taken together, better opportunities and more efficient means should enhance youth' primary control capacities, especially in Western societies where academic performance can be considered the currency that enables people to pursue their socio-economic goals.

An additional process that may underlie our results involves self-perceptions. Because academic performance provides relevant self-evaluative information against a commonly shared standard (i.e., grades), students who are academically successful receive information that may promote their academic self-concept (e.g., Marsh & Craven, 2006), academic self-esteem (e.g., Pullmann & Allik, 2008), and academic self-efficacy (e.g.,

D'Amico & Cardaci, 2003). These domain-specific construct might in turn generalize to other domains (Schunk & Pajares, 2002) and positively influence the choice of activities, effort, and persistence beyond the school context (Bandura, 1986).

Finally, school achievement is likely to influence social interactions with peers, teachers, parents, and significant others. Youth peer groups coalesce around their members' academic performance (Flashman, 2012) and classmates perceived to lack academic ability are viewed as less desirable friends, presumably because of deficits in prosocial behavior (Wentzel & Caldwell, 1997). Relatedly, research demonstrated reciprocal relations between academic performance and social adjustment (e.g., Chen, Rubin, & Li, 1997). In addition, prosocial actions (e.g., cooperating, helping, sharing) were shown to mediate the relations between their school achievement in early childhood and adolescence (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000). Taken together, school performance has the potential to influence social networks and social interactions, either to the better or to the worse. This, in turn, is likely to shape adolescents' socio-emotional development in the long run.

Strengths and Limitations

The longitudinal data used in our analyses represents a major strength of this research for several reasons. First, the sample is large, random, representative of the population, and characterized by low attrition. Second, the study has measured academic performance across the entire time of compulsory schooling in childhood and adolescence using objective standardized tests in the core subjects mathematics and German. The design rules out possible endogeneity biases and the measures are superior to subjective evaluations of academic performance such as grades or self-evaluations. Third, the way academic performance was scaled allowed its interpretation on the same metric scale at the interval level of measurement regardless of the actual school track the students have chosen. This kind of scaling is necessary to meaningfully interpret latent growth models across the entire compulsory

schooling period. Fourth, our analyses incorporated several covariates that can be considered possible confounders of academic performance and strong candidate variables for likely alternative explanations.

We caution against blanket causal interpretations of the link between academic performance and thriving, given the correlational structure of the study and at least four other study characteristics. First of all, PYD has only been assessed once, at T5, so that we cannot control for previous levels of PYD or draw any conclusions about its trajectory over time.

Second, the positive association between academic performance and thriving might actually reflect differences between subgroups from different educational contexts. In terms of the model by Lerner et al. (2015), both thriving and school performance could actually be a main effect of the context rather than a person ↔ context interaction effect. It could be that schools that are good in promoting students' academic performance simultaneously promote PYD by offering extra-curricular programs or supporting a school culture of mutual respect and empathy. School performance and thriving, then, would be two sides of the same institutional intervention. Our results on school bonding indeed lend credence to this idea.

Third, thriving itself could contribute to better academic performance, or at least there could be a reciprocal relation between the two. In research conducted in other cultural contexts, PYD is relatively stable. For instance, Geldhof et al. (2014) have found one-year stabilities ranging $.70 < r_{tt} < .90$ between Grades 5 to 12. Hence, in line with previous research that has identified PYD as a predictor of thriving (e.g., Lewin-Bizan et al., 2010) as well as the absence of problem behavior (e.g., Schwartz et al., 2010), PYD might also function as a factor promoting school performance. Adolescents who consider themselves as competent and have confidence in their skills and faculties will more likely increase their academic performance as suggested by the self-enhancement model (Guay et al., 2003). The present data cannot rule out the possibility that thriving itself drives academic performance.

Fourth and finally, we caution against broadly generalizing these results because of the homogeneity and privilege of this Swiss sample, at least relative to the more-diverse and less-equal U.S. American context.[2] It is possible that pernicious and co-occurring societal factors (e.g., systemic racism, income inequality, variations in school quality) more present in the U.S. American context may attenuate the association between academic performance and thriving. Future work that assesses whether the processes underlying our results hold in educational contexts beyond Switzerland would make a compelling addition to the literature.

Conclusion and future directions

In 1848, the educator Horace Mann wrote "Education then, beyond all other devices of human origin, is a great equalizer of the conditions of men – the balance wheel of the social machinery." Clearly, in many societies, this balance wheel is failing, as social inequalities persist in educational performance and achievement (e.g., Duncan & Murnane, 2011). Despite this persistent inequality in many corners of the globe, this research suggests that those students who do show growth in their academic performance from childhood through adolescence are more likely to thrive as young adults. In short, what happens within schools matters for positive development into adulthood.

Future work must explore how student psychological processes, as well as teacher, classroom and school factors converge to support these findings. Of paramount need is the investigation of the social and psychological processes that link school performance and thriving. Linking these two concepts – that are investigated very intensively on their own but hardly in combination – could open up new pathways for interdisciplinary work combining the developmental and educational sciences. In general, this work must ask for which students, with which psychological and academic characteristics, with teachers with which skills, in schools with which supports, embedded in neighborhoods with which assets, and supported by which kind of parenting and social connections is academic performance most

likely to lead to thriving, and how can we improve classrooms and develop policies to support these relations.

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Footnotes

[1] The only significant effect for the specific factors was that slope of school performance predicted competence (β = -.36; *SE* = .14; *p* = .009). At the first glance, this finding might seem unexpected, but one has to consider that factor here is residualized and hence measures aspects of competence that were not captured in and are unrelated to the PYD factor. The slope of school performance otherwise had no significant association with confidence (β = -.10; *SE* = .09; *p* = .261), character (β = -.26; *SE* = .21; *p* = .221), caring (β = -.084; *SE* = .14; *p* = .547), or connection (β = -.17; *SE* = .11; *p* = .124). Similarly, the intercept of school performance had no significant association with competence (β = .06; *SE* = .17; *p* = .744), confidence (β = .12; *SE* = .09; *p* = .195), character (β = -.18; *SE* = .21; *p* = .388), caring (β = .07; *SE* = .13; *p* = .591), or connection (β = .05; *SE* = .09; *p* = .578). This pattern remained virtually the same after including the respective covariates.

[2] The educational system in the Canton of Zurich is characterized by compulsory school attendance for nine years, standardization in terms of curricula and certificates, virtual nonexistence of private or parish schools, mandatory placement of the children based on their place of residence, relatively low regional disparities, relatively early tracking after Grade 6 solely based on academic performance, a strong system of vocational education offering good prospects for the labor market entry, and very low school dropout rates that are attributed to the fact that vocational education is offered for a very broad range of skills. At the same time, educational attainment is strongly determined by the socio-economic status of the parents. Taken together in technical terms, the family background is decisive for the intercept of a child's school performance trajectory while the slope may be largely independent of the intercept and only moderately correlated with socioeconomic status and not at all correlated with factors such as nationality or place of residence. Of course, there are school composition effects, but there is constant political effort to reduce these effects by, for instance, affirmative

action programs, additional funding, and adjusted student-staff ratios for disadvantaged schools.

[3] We are grateful to the anonymous reviewer who pointed us to this interpretation.

Table 1. Participation rates for the total sample of the Zurich Learning Progress Study unweighted (upper part) and weighted (lower part)

School year	Participation	Non-response	Moved away
T1 (2003/04)	1968 (96%)	75 (4%)	
T2 (2005/06)	1872 (92%)	93 (4%)	76 (4%)
T3 (2008/09)	1679 (82%)	241 (12%)	123 (6%)
T4 (2011/12)	1631 (80%)	248 (12%)	164 (8%)
T5 (2016/17)	1040 (51%)	782 (38%)	221 (11%)

School year	Participation	Non-response	Moved away
T1 (2003/04)	1963 (96%)	80 (4%)	
T2 (2005/06)	1878 (92%)	101 (5%)	64 (3%)
T3 (2008/09)	1639 (80%)	299 (15%)	105 (5%)
T4 (2011/12)	1643 (80%)	249 (12%)	151 (8%)
T5 (2016/17)	1085 (53%)	769 (38%)	189 (9%)

Table 2. Standardized factor loadings of the bi-factor model of PYD.

	Standardized loading λ					
Item	PYD	COMP	CONF	CHAR	CARE	CONN
HART11	.24 (.03)	.46 (.07)				
HART19	.30 (.03)	.24 (.07)				
HART21	.25 (.03)	.48 (.09)				
HART27	.25 (.03)		.76 (.05)			
HART40	.25 (.03)		.64 (.05)			
ABME17[1]	.32 (.03)			.49 (.11)		
AMBE25	.41 (.04)			.25 (.10)		
AMBE35	.33 (.03)			.27 (.08)		
CARE02[1,2]	.38 (.04)				.39 (.06)	
CARE07	.34 (.04)				.67 (.05)	
CARE09	.38 (.04)				.73 (.05)	
NEIG03	.30 (.03)					.82 (.05)
FAMI05[2]	.30 (.03)					.65 (.05)
CLAS03	.28 (.03)					.49 (.04)

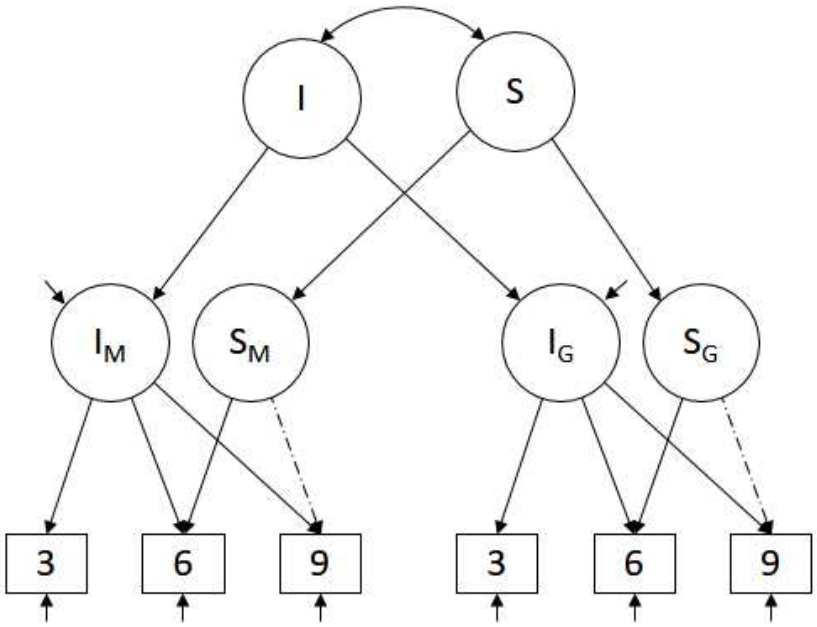
Note: Item labels adopted from Geldhof et al. (2014); Residual error variances between variables indexed with the same superscript were allowed to correlate; Standard errors are provided in brackets; All loadings are significant at $p < .001$ except for CHAR by ABME25 ($p = .004$) and CHAR by ABME35 ($p = .001$). Items HART34, ABME06, and PEER06 not included in the model because of low or negative item-item or item-total correlation.

Table 3. Standardized regression coefficients obtained for all five models.

	Endogenous variable				
	PYD	Performance		School bonding	
		Intercept	Slope	Intercept	Slope
Model 1					
Performance intercept	.02				
Performance slope	.40*				
Model 2					
Performance intercept	.24				
Performance slope	.43**				
Intelligence	-.03				
Knowledge	-.28				
Model 3					
Performance intercept	.30				
Performance slope	.46*				
Intelligence	-.02				
Knowledge	-.29				
Family educational assets	-.09				
Model 4					
Performance intercept	.26				
Performance slope	.43*				
Intelligence	.02				
Knowledge	.06				
Family educational assets	-.01				

Age	.06		
Gender (female)	.19		
Language (foreign)	.12		
Model 5			
Performance intercept	.00		.09*
Performance slope	.16		.19**
School bonding intercept	.61	-.17**	
School bonding slope	.30		

Figure 1. Second-order latent growth model with intercept (I) and slope (S) for academic performance in mathematics (M) and German (G) assessed in Grades 3, 6, and 9.



Note: Solid arrows were fixed to 1, dashed arrows were freely estimated. WLE estimates were used as achievement indicators.

Appendix 1. Scaling procedure.

The scaling in Grade 1 was performed independently from that in the other grades and resulted in three subscales of which we used two, reading competencies and mathematical understanding, to capture pre-schooling knowledge that was related to the elementary school curriculum but also was largely independent of schooling, because it was assessed right after school enrollment. We modelled pre-schooling knowledge as a latent variable and constrained the two loadings to be equal. The scaling in Grades 3, 6, and 9 was performed using the common-item nonequivalent groups design (for details, see Kolen & Brennan, 2004) to link the items on the same metric scale. Because the three year increase in academic performance was too steep for direct linking, we administered adapted achievement tests in additional calibration samples of students from interjacent grades (i.e., 4, 5, 7, and 8). The calibration samples comprised approximately 150 students per grade and the number of link items ranged from approximately 40 to 60 depending on the subject matter and the grade. Furthermore, because tests in Grade 9 were administered in three different forms depending on the actual school track of the students, we tested the respective items for differential item functioning with a many-facet Rasch model (see Linacre, 1994). Only those link items were retained and used that did not exhibit a statistically significant item × school track interaction term, hence minimizing the effect of different curricular influences on the test score. Taken together, our measures were scaled in a way that allowed to compare academic performance across all three grades and all school tracks on the same metric scale at the interval level of measurement.

Appendix 2. Selected examples of instructions and item wordings of the PYD scale.

The following pairs of sentences are talking about two kinds of kids. We'd like you to decide whether you are more like the kids on the left side, or you are more like the kids on the right side. Then we would like you to decide whether that is only sort of true for you or really true for you and mark your answer.

COMPETENCE: Some youths have a lot of friends… but other youths don't have very many friends.

CONFIDENCE: Some youths really like their looks… but other youths wish they looked different.

CHARACTER: Some youths do things they know they shouldn't do…but other youths hardly ever do things they know they shouldn't do.

How important is each of the following in your life? [not important…extremely important]

CHARACTER: Accepting responsibility for my actions when I make a mistake or get in trouble.

How well each of these statements describe you? [not well…very well]

CARING: When I see another person who is hurt or upset, I feel sorry for them.

How much do you agree or disagree with the following? [strongly disagree… strongly agree]

CONNECTION: In my family I feel useful and important.

Note: Instructions and scale anchors are printed in italics and the respective scale is printed in capital letters.